

WHAT IS CLAIMED IS:

1. A method of substantially eliminating the undesirable see-through back image
5 problem in duplicating double-sided documents, comprising:

scanning a front side image and a back side image from the double-sided
document, the front side image having portions, some of the portions including an original
front image and a see-through back image from the back side image;

storing the front side image and the back side image;

10 determining an edge amount for each of the portions in the front side image;

initially separating the see-through back image from the original front image
based upon the edge amount to generate a first process result;

smoothing the portions having a certain amount of the edge amount in the first
process result to generate a smoothed result;

15 further separating character portions and dot pattern portions from background in
the smoothed result to leave background portions; and

correcting an intensity level of the character portions, the dot pattern portions and
the background portions using a corresponding predetermined conversion function so as to
substantially eliminate the see-through back image.

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2. The method of substantially eliminating the undesirable see-through back
image problem in duplicating double-sided documents according to claim 1 wherein the
character portions and the dot pattern portions are further separated from the background
portion based upon binarizing the smoothed result.

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3. The method of substantially eliminating the undesirable see-through back
image problem in duplicating double-sided documents according to claim 1 wherein said
further separating and said correcting steps are performed only when the front side image
has an intensity level below a predetermined threshold value.

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4. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 1 wherein the predetermined conversion function has a set of predetermined parameters for each pixel.

5 5. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 1 further comprising additional steps of:

 determining an average intensity level among the portions of the front side image;

 determining a presence of a pitch frequency in the portions of the front side
10 image;

 wherein said further separating and said correcting steps are performed only when the following conditions are met, the average intensity level being below a predetermined threshold value, the edge amount being relatively small and the pitch frequency being present.

15 6. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 5 wherein the presence of the pitch frequency is determined based upon the use of the distribution Fourier transformation.

20 7. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 5 wherein the presence of the pitch frequency is determined based upon the use of a self correlation
25 function.

 8. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 5 wherein the presence of the pitch frequency is determined based upon the use of information on a peak
30 and a valley of the front side image.

9. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 1 wherein said further separating and said correcting steps are performed at a set of predetermined levels based upon a user input.

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10. The method of substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 1 wherein said further separating and said correcting steps are performed at a set of predetermined levels based upon an image quality level of the front side image.

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11. A system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents, comprising:

a scanner for scanning a front side image and a back side image from the double-sided document, the front side image having portions, some of the portions including an original front image and a see-through back image from the back side image;

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a memory unit connected to said scanner for storing the front side image and the back side image;

an edge amount determination unit connected to said memory unit for determining an edge amount for each of the portions in the front side image;

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a smoothing unit connected to said edge amount determination unit and said memory unit for smoothing the portions having a certain amount of the edge amount in the first process result to generate a smoothed result;

a determination unit connected to said edge amount determination unit and said smoothing unit for initially separating the see-through back image from the original front image based upon the edge amount to generate a first process result, said determination unit further separating character portions and dot pattern portions from background in the smoothed result to leave background portions; and

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a correction unit connected to said determination unit for correcting an intensity level of the character portions, the dot pattern portions and the background portions using a corresponding predetermined conversion function so as to substantially eliminate the see-through back image.

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12. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 11 wherein said determination unit further separates the character portions and the dot pattern portions from the background portion based upon binarizing the smoothed result.

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13. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 11 wherein said determination unit further separates the character portions and the dot pattern portions from the background and said correction unit corrects the intensity level only when the front side
10 image has an intensity level below a predetermined threshold value.

14. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 11 wherein the predetermined conversion function has a set of predetermined parameters for each pixel.

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15. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 11 further comprising:

an average intensity level determination unit connected to said memory unit for
20 determining an average intensity level among the portions of the front side image;

a pitch frequency detection unit connected to said memory unit for determining a presence of a pitch frequency in the portions of the front side image;

wherein said determination unit further separates the character portions and the dot pattern portions from the background and said correction unit corrects the intensity
25 level only when the following conditions are met, the average intensity level being below a predetermined threshold value, the edge amount being relatively small and the pitch frequency being present.

16. The system for substantially eliminating the undesirable see-through back
30 image problem in duplicating double-sided documents according to claim 15 wherein said pitch frequency unit determines the presence of the pitch frequency based upon the use of the distribution Fourier transformation.

17. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 15 wherein said pitch frequency unit determines the presence of the pitch frequency based upon the use of a self correlation function.

18. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 15 wherein said pitch frequency unit determines the presence of the pitch frequency based upon the use of information on a peak and a valley of the front side image.

19. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 11 wherein said determination unit further separates the character portions and the dot pattern portions from the background and said correction unit corrects the intensity level in response to a selected one value from a set of predetermined levels based upon a user input.

20. The system for substantially eliminating the undesirable see-through back image problem in duplicating double-sided documents according to claim 11 said determination unit further separates the character portions and the dot pattern portions from the background and said correction unit corrects the intensity level in response to an image quality level of the front side image.